

## Exercise 3.2 — Mutually exclusive events

**Q1** a)  $P(X \text{ and } Y) = 0$

b)  $P(X \text{ or } Y) = P(X) + P(Y) = 0.48 + 0.37 = 0.85$

c)  $P(X' \text{ and } Y') = 1 - P(X \text{ or } Y) = 1 - 0.85 = 0.15$

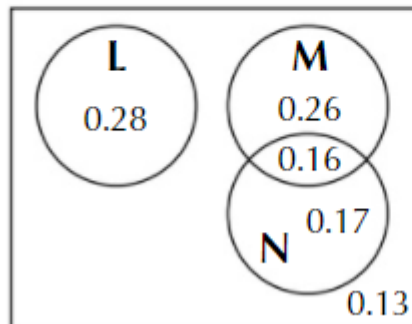
**Q2** a)  $P(L \text{ or } M) = P(L) + P(M) = 0.28 + 0.42 = 0.7$

b)  $P(L \text{ or } N) = P(L) + P(N) = 0.28 + 0.33 = 0.61$

c)  $P(M \text{ or } N) = P(M) + P(N) - P(M \text{ and } N)$   
 $= 0.42 + 0.33 - 0.16 = 0.59$

d)  $P(L \text{ and } M \text{ and } N) = 0$

e) Draw 3 circles to represent events L, M and N, making sure that mutually exclusive events don't overlap. As usual, start the labelling with the middle of the overlapping circles and work outwards.



**Q3** a) Let B = 'goes bowling', C = 'goes to the cinema', and D = 'goes out for dinner'. All 3 events are mutually exclusive, so:

$$P(B \text{ or } C) = P(B) + P(C) = 0.17 + 0.43 = 0.6$$

b)  $P(\text{doesn't do B, C or D})$

$$= P(B' \text{ and } C' \text{ and } D')$$

Since either none of B, C and D happen, or at least one of B, C and D happen, " $B'$  and  $C'$  and  $D'$ " and " $B$  or  $C$  or  $D$ " are complementary events. So:

$$P(B' \text{ and } C' \text{ and } D') = 1 - P(B \text{ or } C \text{ or } D)$$

$$= 1 - [P(B) + P(C) + P(D)]$$

$$= 1 - (0.17 + 0.43 + 0.22) = 1 - 0.82 = 0.18$$

**Q4** a)  $P(A \text{ and } B) = P(A) + P(B) - P(A \text{ or } B)$

$$= 0.28 + 0.66 - 0.86 = 0.08$$

$P(A \text{ and } B) \neq 0$ , so A and B aren't mutually exclusive.

b)  $P(A \text{ and } C) = P(A) + P(C) - P(A \text{ or } C)$

$$= 0.28 + 0.49 - 0.77 = 0$$

$P(A \text{ and } C) = 0$ , so A and C are mutually exclusive.

c)  $P(B \text{ and } C) = P(B) + P(C) - P(B \text{ or } C)$

$$= 0.66 + 0.49 - 0.92 = 0.23$$

$P(B \text{ and } C) \neq 0$ , so B and C aren't mutually exclusive.

**Q5** a) You need to show that  $P(C \text{ and } D) = 0$ .

$$P(C) = 1 - 0.6 = 0.4$$

$$P(C \text{ and } D) = P(C) - P(C \text{ and } D') = 0.4 - 0.4 = 0,$$

so C and D are mutually exclusive.

b)  $P(C \text{ or } D) = P(C) + P(D) = 0.4 + 0.25 = 0.65$

**Q6** Out of the total of 50 biscuits, 30 are plain, and 20 are chocolate-coated. Half of the biscuits are in wrappers, so 25 biscuits are in wrappers. Since there are more biscuits in wrappers than there are chocolate-coated ones, there must be some biscuits (at least 5) which are plain and in wrappers. So events P and W can happen at the same time (i.e.  $P(P \text{ and } W) \neq 0$ ), which means they are not mutually exclusive.